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THE PROBLEM OF SURGICAL TREATMENT OF PERIPHERAL PARALYSES OF THE FACIAL NERVE FOLLOWING A RADICAL REMOVAL OF ACOUSTIC NERVE NEURINOMAS

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THE PROBLEM OF SURGICAL TREATMENT OF PERIPHERAL PARALYSES OF THE FACIAL NERVE FOLLOWING A RADICAL REMOVAL OF ACOUSTIC NERVE NEURINOMAS

[Following is the translation of an article by V. S. Alekseyeva entitled K Voprosu o Khirurgicheskom Lechenii Periphericheskikh Paralichey Litsevogo Nerva Posle Radikal'nogo Udaleniya Nevrinom Slukhovogo Nerva (English version above), in Voprosy Neyrokhirurgii (Problems of Neurosurgery), Vol. XXIV, No. 3, Moscow, 1960, pages 52-54.]

Radical removal of acoustic nerve neurinomas, as a rule, is complicated by the development of peripheral facial nerve paralysis.

The anatomic-topographic characteristics of growth of neurinomas and the intimate association of the trunk of the facial nerve with the tumor leads to an early compression and displacement of the nerve by the tumor; the facial nerve is pushed out, thins out, and frequently its fibers grow into the tumor capsule. Despite considerable anatomic changes in the facial nerve, its function does not suffer for a long time.

In recent years, total removal of acoustic nerve neurinomas has been accomplished more often; in connection with this, the problem of recovery of function of the injured facial nerve is becoming of current importance.

Numerous surgical methods have been proposed for improving or restoring the function of the facial nerve: corrective operations, muscle plastic operations, muscle neurotizations, operations on the sympathetic nervous system, and in the facial canal when the

nerve is injured in it.

On the basis of clinical-physiological observations and a study of the late results after the operative treatment of peripheral facial nerve paralyses we believed that the operation of suturing the peripheral end of the facial nerve with the central end of other cranial nerves has a sounder basis, which is in agreement with the opinion of a number of authors (V. P. Voznesenskiy, 1928; V. L. Pokotilo, 1924; N. N. Burdenko, 1934; P. N. Bulatov, 1946; V. S. Alekseyeva, 1952; Ballance, 1924; Mackenzie, 1959; Coleman and Walker, 1956 and many others).

The topographical-anatomic data make it possible to perform a suturing operation of the facial nerve with the accessory, hypoglossal or its descending branch, the glossopharyngeal and the phrenic nerves. Here, the severity of muscle paralysis after transection of a nerve designed for anastomosis as well as the possibility of an easier differentiation of associated movements should be taken into consideration here.

Operations for peripheral facial nerve paralyses were performed on 45 patients at the Institute of Neurosurgery. In the majority of cases the peripheral end of the facial nerve was sutured to one of the branches of the accessory nerve.

Without dealing with the technique of the operative procedure (Voprosy neykhirurgii /Problems of Neurosurgery/, 1952, No. 3), it should be noted that recently a method for cementing the nerve ends together has been worked out.

The operation of the facial nerve anastomosis with the spinal

accessory nerve from the physiological viewpoint should be regarded as a cross union of nerves which belong to different functional systems. In studies which come from the laboratory directed by P. K. Anokhin, certain general rules and regulations of the reorganization of the central-peripheral connections following the anastomosis of two nerves with different functions have been shown.

What are the consequences of suturing the peripheral end of an injured facial nerve to the central end of the spinal accessory nerve and what is the final result of their regeneration process? Muscles of the face innervated by the spinal accessory nerve should be included in a functional system which has reference to the centers for the arm, including the nucleus of the spinal accessory nerve. Functional success of the operation may be achieved only if the spinal accessory nerve nucleus is excluded from its former excitation systems and included in functional systems which refer primarily to the facial nerve nucleus. These physiological reorganization processes may occur only if the reverse afferent impulses which arise from contraction of the facial muscles inhibit the excitation of the spinal accessory nerve occurring within the limits of its former functional systems.

Success may be attained only after two necessary differentiations occur in these cases: 1) the nucleus of the spinal accessory nerve stops being excited by the extremity movements; 2) the nucleus is readily excited in cases of the occurrence of functional systems which include the previous facial nerve nucleus. This

reorganization process occurs only after powerful afferent impulses from the periphery signalize the continuing associated movements of the facial muscles and these signals are used by the cortical (pyramidal) control for the purpose of retraining.

A separation of the functions of the mimicking muscles of the entire half of the face from the associated functions of the arm musculature occurs but differentiation of various facial expressions is quite difficult to achieve. This result may be explained by two characteristics of this anastomosis. First of all, for the purpose of differentiating the movements for various muscles of the face it is essential to differentiate the spinal accessory nerve nucleus and, secondly, it is essential that the excitation pass through the nerve scar in a differentiated manner, along individual fibers. Such a differentiation is difficult, but by means of prolonged special exercises it may be achieved.

The data presented concerning the reorganization conditions in the spinal accessory nerve nucleus make it possible to draw a practical conclusion concerning the most acceptable anastomoses for recovery of the facial nerve function.

Which of the nerve trunks can be considered more acceptable for the purpose of obtaining greater success from the anastomosis?

Evidently, neither the anatomic proximity of the central apparatuses nor the volume of the peripheral innervation can

serve as an adequate basis for achieving this success, since anatomically related nerve nuclei may be "final pathways" for very different reflex acts. Therefore, a heterogenous anastomosis which connects nerves belonging to a single functional system or at least to two systems which are functionally very similar to each another can be most successful.

The degree of differentiation of the cerebral nerve nucleus and the degree of its subordination to cortical control may also influence the choice of the nerve for anastomosis.

From all these points of view the anastomosis of the spinal accessory nerve with the facial nerve should be considered most expedient, because it best provides for physiological retraining. Anastomosis of the hypoglossal nerve with the facial nerve, from our viewpoint, is not so suitable. In the case of differentiation of excitations of the hypoglossal nerve nucleus because of the characteristics of lingual function undoubtedly great difficulties are encountered, since during the period of training the tongue has to accomplish many haphazard movements. On the other hand, the hypoglossal nerve nucleus has no promise for fine differentiations of the tongue muscles because of the special structure of the tongue muscles.

In addition to the physiological basis mentioned, other factors -- the more complex topographic location of the hypoglossal nerve, the occurrence of associated movements on eating, speaking, and the development

of atrophy of half of the tongue, which interferes with speech, mastication -- confirm the fact that the application of the hypoglossal nerve for anastomosis with the facial nerve is without a good basis.

The use of the phrenic nerve is also unsound physiologically, because exclusion of the mobility of half of the diaphragm has a severe influence on the respiratory function. The anatomic location of the glossopharyngeal nerve, the small diameter of its trunk do not give any preference to this nerve for the purpose of anastomosis with the facial.

The results of the operation are not expressed immediately. For a long time associated movements are inevitable.

A year after the operation active movements in the face may be achieved with a partial dissociation from the associated movements. Two to two and a half years after the operation the recovery of complete facial symmetry at rest and of voluntary movements of satisfactory degree is noted; however, during emotion a facial asymmetry is still noticeable. During this period a complete recovery is noted of the electrical excitability and of chronaxie in the facial nerve and in the muscles of facial expression, but the range of movement in them is decreased by comparison with the healthy side. Afterwards, the volume of voluntary movements improves progressively.

Signs of loss of function in the transected branch of the spinal accessory nerve are insignificant. Therefore, by means of suturing

the peripheral end of the facial nerve with the central end of a branch of the spinal accessory it is possible to eliminate a disfiguring paralysis of a half of the face and to achieve complete symmetry of the face at rest. In movements of facial expression, particularly during emotion, a certain lag remains in the function of muscles of the affected side of the face, but almost always it is possible to achieve a differentiation of associated movements by means of appropriate exercises.

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